

Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

B1 51. (Previously Presented) An optical disk for recording information thereon and reproducing the information therefrom, the optical disk being housed rotatably in a cartridge case:

a disk substrate having a hole formed through the center thereof;

a recording layer which is formed on the substrate and on which the information is recorded;

a hub provided on the center of the substrate so as to be movable relative to the substrate, the hub having an outer diameter which is 26 or more % of that of the optical disk;

the optical disk satisfies a relationship of $Y/X \geq 0.015$, where X is a projected area of the substrate and Y is a contact area between the hub and the substrate.

52. (Previously Presented) The optical disk according to Claim 51, wherein the cartridge case defines a space therein, and a size of the space is 300 or more % of a thickness of the substrate.

53. (Previously Presented) The optical disk according to Claim 51, wherein the cartridge case has a recess and a protrusion formed on the inner surfaces thereof which face the disk, and the recess and protrusion adjust airflow in the cartridge case while the disk is rotating and are arranged to diverge away from the center of the disk at angle between 5 and 90 degrees.

54. (Previously Presented) The optical disk according to Claim 51, wherein the hub has a convex center portion with a side wall sloping at an angle between 130 and 160 degrees at half the height of the hub.

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55. (Previously Presented) The optical disk according to Claim 51 wherein the substrate has a thickness of 0.7 or less mm.

56. (Previously Presented) The optical disk according to Claim 51, wherein the projected area X and the contact area Y satisfy the relationship of $Y/X \geq 0.02$.

57. (Previously Presented) The optical disk according to Claim 56, wherein the disk is rotated at a speed of 2,400 or more rpm for recordation and reproduction.

58. (Currently Amended) A disk substrate for an optical disk which is mounted on a magnetic mounting part of a driving apparatus for driving the optical ~~disk~~ disk comprising:

a disk plane tilting substantially with respect to a plane perpendicular to an axis of rotation of the substrate; and

a hub which is attractable by the magnetic part to press the optical disk in such manner that the disk plane becomes horizontal when the disk is mounted on the mounting part of the driving apparatus.

59. (Previously Presented) The disk substrate according to Claim 58 wherein the substrate has a thickness of less than 0.8 mm.

60. (Previously Presented) The disk substrate according to Claim 58, further comprising a cylindrical receptacle formed in a center thereof for holding the hub, the receptacle having a hole formed through the bottom thereof coaxially with the axis of rotation.

61. (Previously Presented) The disk substrate according to Claim 60, wherein the disk plane tilts at an angle θ away from the bottom of the cylindrical receptacle, and the angle θ satisfies the relationship of $1 \text{ mrad} \leq \theta \leq 20 \text{ mrad}$.

62. (Previously Presented) The disk substrate according to Claim 61, wherein the hub is held movably in the cylindrical receptacle.

63. (Previously Presented) The disk substrate according to Claim 62, wherein the disk substrate has a thickness between 0.1 and 0.7 mm.

64. (Previously Presented) The disk substrate according to Claim 58, a relationship of $Y/X \geq 0.015$ is satisfied, where X and Y respectively denote the projected area of the substrate and the contact area between the hub and the substrate.

65. (Previously Presented) The disk substrate according to Claim 58, wherein the hub has an outer diameter that is 26 or more % of the outer diameter of the substrate.

66. (Previously Presented) An optical disk which has the disk substrate according to Claim 58.

67. (Currently Amended) A disk substrate for an optical disk, the substrate having an axis of rotation and a thickness of less than 0.8 mm, wherein a disk plane tilts at a tilt angle θ , which satisfies $1 \text{ mrad} \leq \theta \leq 20 \text{ mrad}$, with a plane perpendicular to the axis of rotation.

68. (Previously Presented) The disk substrate according to Claim 67, further comprising a hub that can be magnetically attracted.

69. (Canceled)

70. (Currently Amended) The disk substrate according to Claim ~~69~~, 67, further comprising a cylindrical receptacle formed in the center thereof for holding the hub, the receptacle having a hole formed through the bottom thereof coaxially with the axis of rotation.

71. (Previously Presented) The disk substrate according to Claim 70, wherein the hub is held movably in the cylindrical receptacle.

72. (Currently Amended) The disk substrate according to Claim ~~69~~, 67, wherein the disk substrate has a thickness between 0.1 and 0.7 mm.

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73. (Previously Presented) The disk substrate according to Claim 68, wherein a relationship of $Y/X \geq 0.015$ is satisfied, where X and Y respectively denote the projected area of the substrate and the contact area between the hub and the substrate.

74. (Previously Presented) The disk substrate according to Claim 68, wherein the hub has an outer diameter that is 26 or more % of the outer diameter of the substrate.

75. (Previously Presented) An optical disk including the disk substrate according to Claim 68.

76. (Currently Amended) A driving apparatus for driving a record disk having a tilt and a hub which is magnetically attracted to press the record disk, comprising:

a driving unit; and

a support for supporting a part of the record disk to adjust the tilt of the record disk as the hub presses the record disk against the support.

77. (Previously Presented) The driving apparatus according to Claim 76, wherein the record disk has an axis of rotation and a disk plane substantially tilting with respect to a plane perpendicular to the axis of rotation.

78. (Previously Presented) The driving apparatus according to Claim 76, wherein the record disk has an axis of rotation, a thickness of less than 0.8 mm and a disk plane tilting at a tilt angle θ with a plane perpendicular to the axis of rotation, the tilt angle θ satisfying the relationship of $1 \text{ mrad} \leq \theta \leq 20 \text{ mrad}$.

79. (Previously Presented) The driving apparatus according to Claim 76, wherein the record disk has an axis of rotation and a cylindrical receptacle for holding the hub, the receptacle having a hole formed through the bottom thereof coaxially with the axis of rotation.

80. (Previously Presented) The driving apparatus according to Claim 77, wherein

the driving unit has a rotating shaft for rotating the record disk, and the support is formed at the top of the shaft.

81. (Previously Presented) The driving apparatus according to Claim 79, wherein the driving unit has a rotating shaft for rotating the record disk, the rotating shaft has a cylindrical recess formed coaxially in the top thereof for holding the cylindrical receptacle, the rotating shaft also has a side wall defining the recess, and the support is formed at the top of the side wall.

82. (Previously Presented) The driving apparatus according to Claim 81, wherein the rotating shaft protrudes axially from the bottom of the cylindrical recess, and the shaft includes:

a first columnar protrusion having an outer diameter larger than that of the hole in the bottom of the record disk; and

a second columnar protrusion protruding coaxially from the first protrusion axially of the rotating shaft.

83. (Previously Presented) The driving apparatus according to Claim 79, wherein the disk plane tilts at an angle θ with a direction perpendicular to the axis of rotation away from the bottom of the cylindrical receptacle, and the angle θ satisfies a relationship of $1 \text{ mrad} \leq \theta \leq 10 \text{ mrad}$.

84. (Previously Presented) The driving apparatus according to Claim 81, wherein the top of the cylindrical wall defining the recess of the rotating shaft extends radially outward.

85. (Previously Presented) The driving apparatus according to Claim 82, wherein, when the record disk is mounted on the driving apparatus, the hole of the disk engages with the second protrusion to support the disk plane of the disk on top of the horizontal support,

whereby the disk plane is kept at an angle of 10 or less mrad with a plane perpendicular to the axis of rotation of the disk.

86. (Previously Presented) The driving apparatus according to Claim 80 the rotating shaft includes a magnet fitted therein for attracting the hub.

87. (Previously Presented) The driving apparatus according to Claim 86, wherein the magnet is an electromagnet.

88. (Previously Presented) A driving apparatus for recording and reproducing information by radiating light onto the recording surface of a record disk including a hub that is magnetically attracted to press a part of the disk, comprising:

a light source for irradiating the record disk with light;

a tilt sensor for measuring a tilt angle of the recording surface of the record disk relative to the optical axis of the light incident on the disk;

a rotating shaft for rotating the record disk;

an electromagnet embedded in the rotating shaft; and

a controller for controlling the magnetic field intensity of the electromagnet based on the tilt angle detected by the tilt sensor, and for adjusting the force with which the hub presses the disk plane of the record disk.

89. (Previously Presented) The driving apparatus according to Claim 88, wherein the disk plane substantially tilts with respect to a plane perpendicular to the axis of rotation of the record disk.

90. (Previously Presented) The driving apparatus according to Claim 88, wherein the record disk has a thickness of less than 0.8 mm, the disk plane tilts at a tilt angle θ , which satisfies a relationship of $1 \text{ mrad} \leq \theta \leq 20 \text{ mrad}$, with a plane perpendicular to the axis of rotation of the disk.

91. (Previously Presented) The driving apparatus according to Claim 88, wherein the record disk includes a cylindrical receptacle for holding the hub, and the receptacle has a hole formed through the bottom thereof coaxially with the axis of rotation of the disk.

92. (Previously Presented) The driving apparatus according to Claim 89, wherein the controller controls the electromagnet to rotate the record disk so that the disk plane makes an angle of 10 or less mrad with the plane perpendicular to the axis of rotation.

93. (Previously Presented) The driving apparatus according to Claim 91, wherein the disk plane tilts at an angle θ with a direction perpendicular to the axis of rotation away from the bottom of the cylindrical receptacle, and the angle θ satisfies a relationship of 1 mrad $\leq \theta \leq 20$ mrad.

94. (Previously Presented) The driving apparatus according to Claim 91, wherein the rotating shaft includes a support on top, on which the cylindrical receptacle can rest, and the support includes:

a first columnar protrusion protruding coaxially with the rotating shaft and having an outer diameter larger than that of the hole in the bottom of the record disk; and

a second columnar protrusion protruding from the first protrusion coaxially with the rotating shaft.

REMARKS

Claims 51-68 and 70-94 are pending in this Application. By this Amendment, claims 58, 67, 70, 72 and 76 are amended. Claim 69 is canceled without prejudice to, or disclaimer of, the subject matter contained therein. Reconsideration based on the above amendments and the following Remarks is respectfully requested.

I. Allowable Subject Matter

The Office Action, in paragraph 15, states that claims 88-94 are allowed. Applicants appreciate the allowance of these claims.

II. Claim Rejections Under 35 U.S.C. §102

The Office Action, in paragraph 4, rejects claim 67 under 35 U.S.C. §102(b) as being anticipated by Japanese Patent No. JP 10-081964 A to Akiyama et al. (hereinafter "Akiyama"). This rejection is respectfully traversed.

Akiyama is directed to improving mechanical characteristics of a substrate such as warp or tilt after the substrate has been subjected to sputtering so that an optical recording medium small in distortion can be produced (Abstract and blocks [0009] and [0014] of the attached computer-generated English language translation).

Akiyama teaches, in Table I, disk substrates for optical disks having a thickness of 0.6 mm in which a tilt angle (tilt angle at an outer circumference portion of the recording medium, radius of the medium: 56 mm) is 4.1 mrad (Example 3), 3.5 mrad (Example 4) and 8.3 mrad (Comparative Example 2), respectively. Applicants respectfully submit that the disk substrate having the tilt angle of 8.3 mrad, the greatest tilt angle listed in Akiyama, is merely a disk of Comparative Example 2, rather than a disk substrate of Examples with which the object of Akiyama's invention can be achieved. Applicants further respectfully submit that Akiyama is silent regarding the features of Applicants' claim 67. Akiyama, in fact, suggests that the mechanical characteristics of a disk substrate become worse as the tilt angle is

increased. As such, one of ordinary skill in the art would not have set the tilt angle of the disk substrate disclosed in Akiyama to a tilt angle θ , which satisfies $10 \text{ mrad} \leq \theta \leq 20 \text{ mrad}$, with a plane perpendicular to the axis of rotation, as is recited, among other features, in claim 67.

Applicants respectfully submit that this feature of the tilt angle makes clear the inventive concept that the disk is formed with a tilt angle and a tilt is adjusted so that the disk plane is kept horizontal by, for example, systems and methods defined in other claims, i.e., claim 76, when the disk is mounted on a driving unit. Applicants further respectfully submit that there is no conventional substrate manufactured with its substrate plane (middle plane) tilted in advance with respect to a plane perpendicular to the rotational axis as disclosed varyingly in the claims of this invention (Specification, page 14, lines 1-16; page 62, lines 14-18 and page 63, lines 14-17). Reconsideration and withdrawal of the rejection of claim 67 under 35 U.S.C. §102(b) as being anticipated by Akiyama are respectfully requested.

The Office Action, in paragraph 5, rejects claims 76, 77, 80 and 86 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,731,929 to Chaya. This rejection is respectfully traversed.

Chaya teaches a clamping mechanism for clamping both a mechanically clampable type of disk and a magnetically clampable type of disk (Abstract). Applicants respectfully submit that Chaya neither teaches nor suggests a support for supporting a part of the record disk to adjust the tilt of the record disk as the hub presses the record disk against the support, as is recited, among other features, in independent claim 76. Applicants further respectfully submit that dependent claims 77, 80 and 86 include all of the features of independent claim 76 from which they depend, and, as such, are also neither taught nor suggested by Chaya. Reconsideration and withdrawal of the rejection of claims 76, 77, 80 and 86 under 35 U.S.C. §102(b) as being anticipated by Chaya are respectfully requested.

III. Claim Rejections Under 35 U.S.C. §103

The Office Action, in paragraph 6, rejects claims 51, 52, 54 and 56 under 35 U.S.C. §103(a) as being unpatentable over Japanese Patent No. JP 6-111518A to Abiko in view of U.S. Patent No. 4,785,444 to Nakane et al. (hereinafter "Nakane"). This rejection is respectfully traversed.

Abiko is directed to an apparatus for holding a metallic plate in a loose fitting state to a disk substrate without slipping out of the disk substrate without subjecting to a swagging process, and to greatly improving the reliability of a recording disk (Abstract, emphasis added). Applicants respectfully submit that Abiko fails to teach the optical disk satisfying a relationship of $Y/X \geq 0.015$, where X is a projected area of the substrate and Y is a contact area between the hub and the substrate, as is recited, among other features, in independent claim 51 (see specifically block [0013] of the computer-generated English language translation of Abiko attached).

Nakane discloses a magneto-optical disk 1 with a substrate of a disk main body 2 made of the polycarbonate resin molded article and having a thickness of 2 mm and an outer diameter of 130 mm, hub 4 made of the polycarbonate resin molded article and having the outer diameter of 32 mm and the thickness of 2 mm (col. 6, lines 39-47). Nakane therefore discloses a hub having an outer diameter which is approximately 24.6% of the optical disk. As such, Applicants respectfully submit that Nakane neither discloses nor suggests the hub having an outer diameter which is 26 or more % of that of the optical disk, as is recited, among other features, in independent claim 51.

Applicants' Specification discloses that the formed substrate 11 has an outer diameter of 122 mm (page 51, line 3) and that the hub 3 has an outer diameter of 31.72 mm, specifically 26% of the disk diameter (page 55, lines 14-15). This feature of the invention

disclosed in Applicants' Specification is included to minimize the irregular rotation of the disk, turbulence caused by the rotation of the disk in the cartridge and camming of the optical disk which may be generated by the irregular rotation or the turbulence caused by the rotation of the disk (page 35, line 17-page 36, line 4).

Applicants respectfully submit that neither Abiko nor Nakane, nor the combination of these references, suggests, or provides motivation for, the features recited in independent claim 51. Applicants further respectfully submit that dependent claims 52, 54 and 56 include all of the features of independent claim 51 from which they depend, in addition to the separately patentable features contained in those claims, and as such are also neither suggested by, nor rendered obvious over, the combination of the applied references. Reconsideration and withdrawal of the rejection to claims 51, 52, 54 and 56 under 35 U.S.C. §103(a) as being unpatentable over Abiko in view of Nakane are respectfully requested.

The Office Action, in paragraph 7, rejects claim 53 under 35 U.S.C. §103(a) as being unpatentable over Abiko in view of Nakane as applied to independent claim 51, and further in view of U.S. Patent No. 6,014,365 to Tanaka; in paragraph 8, rejects claim 55 under 35 U.S.C. §103(a) as being unpatentable over Abiko in view of Nakane as applied to independent claim 51, and further in view of U.S. Patent No. 6,222,812 to Yoo et al. (hereinafter "Yoo"); and in paragraph 9, rejects claim 57 under 35 U.S.C. §103(a) as being unpatentable over Abiko in view of Nakane as applied to claim 56 and further in view of U.S. Patent No. 6,266,298 to Tsai. These rejections are respectfully traversed.

Tanaka discloses a cartridge case which arguably has a recess and a protrusion formed on the inner surfaces thereof arranged to diverge away from the center of the disk at angles between 5° and 90° (Fig. 3).

Yoo discloses an optical pickup apparatus having compatibility with a recordable compact disk and a digital video disk. Yoo simply mentions a DVD disk having a thickness of 0.6 mm (col. 1, line 65).

Tsai teaches an apparatus and method for inscribing a clock pattern, detecting the clock pattern optically, and using the clock pattern to write a servo pattern in an information storage unit, such as a computer hard drive (Abstract). Tsai discloses that the platter of media disks is brought up to its operating speed, which commonly will be 5,400, 7,200 or even 10,000 rpm, all of which are greater than 2,400 rpm (col. 2, lines 37-39).

Nothing in Tanaka, Yoo or Tsai teaches a hub having outer diameter which is 26 or more % of that of the optical disk, or an optical disk that satisfies a relationship of $Y/X \geq 0.015$. As such, Tanaka, Yoo and Tsai do not overcome the shortfall of Abiko and Nakane in their application to independent claim 51, as argued above. Thus, the combination of the applied references neither suggests nor provides motivation for all of the features of dependent claims 53, 55 and 57, which, though separately patentable, depend from independent claim 51 and include all of the features of that claim. Reconsideration and withdrawal of the rejections to claims 53, 55 and 57 under 35 U.S.C. §103(a) as being unpatentable over the respective combinations of the applied references is respectfully requested.

The Office Action, in paragraph 10, rejects claims 58-61, 66, 68-70, 72 and 75-79 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,154,411 to Sandstrom et al. (hereinafter "Sandstrom") in view of Akiyama.

Sandstrom is directed to precise centering of a disk for a disk alignment mechanism on the hub assembly (Abstract, emphasis added). Applicants respectfully submit that Sandstrom, even in combination with Akiyama, neither discloses nor suggests a disk plane

tilting substantially with respect to a plane perpendicular to an axis of rotation of the substrate; and a hub which is attractable by the magnetic part to press the optical disk in such a manner that the disk plane becomes horizontal when the disk is mounted on the mounting part of the driving apparatus, as is recited, among other features, in independent claim 58.

Applicants further respectfully submit that each of the dependent claims 59-61 and 66 include all the features of independent claim 58 from which they respectively depend and as such are neither suggested nor motivated by the combination of the applied references.

As noted above, Akiyama does not anticipate the feature of independent claim 67. Dependent claims 68-70, 72 and 75, in addition to the separately patentable features recited in each of those claims, include all the features of independent claim 67 from which they respectively depend. Applicants respectfully submit that Sandstrom does not overcome the shortfall in the application of Akiyama to the features recited in claim 67 and as such the combination of the applied references does not anticipate, suggest or provide motivation for the features of claims 68-70, 72 and 75.

Applicants respectfully submit that the combination of Sandstrom and Akiyama do not disclose a support for supporting a part of the record disk to adjust the tilt of the record disk as the hub presses the record disk against the support as is recited, among other features, in independent claim 76. Applicants further respectfully submit that dependent claims 77-79 include all the features of independent claim 76, in addition to the separately patentable subject matter contained in those claims.

Based on the foregoing, reconsideration and withdrawal of the rejection of claims 58-61, 66, 68, 70, 72 and 75-79 under 35 U.S.C. §103(a) as being unpatentable over the combination of the applied references are respectfully requested.

The Office Action, in paragraph 11, rejects claims 81-85 under 35 U.S.C. §103(a) as being unpatentable over Sandstrom in view of Akiyama as applied to claim 79 further in view of Chaya. This rejection is respectfully traversed.

Applicants respectfully submit that, for the reasons noted above, the combination of the applied references does not overcome any shortfall in the application of Sandstrom and Akiyama in rejecting independent claim 76, and dependent claim 79, from which claims 81-85 depend and the features of which they include, along with the separately patentable features recited in those claims. Reconsideration and withdrawal of the rejection to claims 81-85 under 35 U.S.C. §103(a) as being unpatentable over the combination of the applied references are respectfully requested.

The Office Action, in paragraph 12, rejects claims 62-64, 71 and 73 under 35 U.S.C. §103(a) as being unpatentable over Sandstrom in view of Akiyama as applied to claim 61 and further in view of Abiko; in paragraph 13, rejects claims 65 and 70 under 35 U.S.C. §103(a) as being unpatentable over Sandstrom in view of Akiyama as applied to claims 58 and 68 and further in view of Nakane; and in paragraph 14 rejects claim 87 under 35 U.S.C. §103(a) as being unpatentable over Chaya in view of Sandstrom. These rejections are respectfully traversed.

Applicants respectfully submit that although claims 62-65, 71, 73, 74 and 87 recite separately patentable subject matter over the independent claims from which they respectively depend, given the arguments that are made above in overcoming the enumerated rejections to independent claims 58, 67 and 76, the combinations of the applied references in each case do not overcome the shortfalls in the application of the previously applied references to each of the independent claims. Reconsideration and withdrawal of the rejections to claims 62-65, 71, 73, 74 and 87 under 35 U.S.C. §103(a) as being unpatentable over the respective combinations of the applied references are respectfully requested.